

CLAIMS

- Sub B*
1. Use as foaming agents having a low environmental impact of azeotropic or near azeotropic compositions, based on difluoromethoxy-bis(difluoromethyl ether) and/or 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl difluoromethyl ether, essentially consisting of:

composition
% by weight

I)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); n-pentane	1-95 99-5
II)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); iso-pentane	1-99 99-1
III)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); dimethyl ketone (acetone)	1-60 99-40
IV)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); 1,1,1,3,3-pentafluorobutane (CF ₃ CH ₂ CF ₂ CH ₃ , HFC 365 mfc)	1-99 99-1
V)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); 1,1,1,4,4,4-hexafluorobutane (CF ₃ CH ₂ CH ₂ CF ₃ , HFC 356 ffa)	1-40 99-60
VI)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); methoxymethyl methylether	1-96 99-14
VII)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); n-hexane	30-99 70-1
VIII)	1-difluoromethoxy	

	1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); n-pentane	1-93 99-7
IX)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); dimethyl ketone (acetone)	30-99 70-1
X)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); n-hexane	15-99 85-1
XI)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); ethyl alcohol	5-99 95-1

2. Use of azeotropic or near azeotropic compositions according to claim 1 essentially consisting of:

	composition % by weight
I)	25-95 75-5
II)	25-98 75-2
III)	20-60 80-40
IV)	10-98 90-2
V)	difluoromethoxy

	bis(difluoromethyl ether) (HCF ₂ OCF ₂ H); 1,1,1,4,4-hexafluorobutane (CF ₃ CH ₂ CH ₂ CF ₃ , HFC 356 ffa)	10-40 90-60
VI)	difluorometoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ H); methoxymethyl methylether	25-96 75-14
VII)	difluoromethoxy bis(difluoromethyl ether) (HCF ₂ OCF ₂ H); n-hexane	35-98 65-2
VIII)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); n-pentane	25-93 75-7
IX)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); dimethyl ketone (acetone)	50-98 50-2
X)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); n-hexane	25-98 75-2
XI)	1-difluoromethoxy 1,1,2,2-tetrafluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); ethyl alcohol	10-98 90-2

a 3. Use of azeotropic compositions according to claims 1
and 2 in correspondence of which an absolute minimum or
maximum of the boiling temperature at the pressure of
1.013 bar with respect to the pure products is noticed,
defined as follows:

A) difluoromethoxy-bis

	(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); n-pentane	62% by wt. 38% by wt.
B)	difluoromethoxy- bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); iso-pentane	63% by wt. 36% by wt.
C)	difluoromethoxy- bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); dimethyl ketone (acetone)	42% by wt. 58% by wt.
D)	difluoromethoxy- bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); 1,1,1,3,3-pentafluorobutane (CF ₃ CH ₂ CF ₂ CH ₃ , HFC 365 mfc)	60% by wt. 40% by wt.
E)	difluoromethoxy- bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); 1,1,1,4,4,4-hexafluorobutane (CF ₃ CH ₂ CH ₂ CF ₃ , HFC 356 ffa)	20% by wt. 80% by wt.
F)	difluoromethoxy- bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); methoxymethyl methyl ether	59% by wt. 41% by wt.
G)	difluoromethoxy- bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); n-hexane	75% by wt. 25% by wt.
H)	1-difluoromethoxy-1,1,2,2-tetra- fluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); n-pentane	61% by wt. 39% by wt.
I)	1-difluoromethoxy-1,1,2,2-tetra- fluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); dimethyl ketone (acetone)	79% by wt. 21% by wt.
L)	1-difluoromethoxy-1,1,2,2-tetra- fluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H); n-hexane	74% by wt. 26% by wt.
M)	1-difluoromethoxy-1,1,2,2-tetra- fluoroethyl difluoromethyl ether (HCF ₂ OCF ₂ CF ₂ OCF ₂ H);	95% by wt.

ethyl alcohol

5% by wt.

4. Use as foaming agents of near azeotropic compositions

a according to ~~claims 1 and 2~~ essentially consisting of:

*A*composition
% by wt.

II)	difluoromethoxy-bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); iso-pentane	1-99 99-1
III)	difluoromethoxy-bis(difluormethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); dimethyl ketone (acetone)	1-60 99-40
IV)	difluoromethoxy-bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); 1,1,1,3,3-pentafluorobutane (CF ₃ CH ₂ CF ₂ CH ₃ , HFC 365 mfc)	1-99 99-1
V)	difluoromethoxy-bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); 1,1,1,4,4,4-hexafluorobutane (CF ₃ CH ₂ CH ₂ CF ₃ , HFC 356 ffa)	1-40 99-60
VI)	difluoromethoxy-bis(difluoromethyl ether) (HCF ₂ OCF ₂ OCF ₂ H); methoxymethyl methyl ether	1-96 99-14

wherein the difluoromethoxy-bis(difluoromethyl ether) part contains up to 40% by weight of 1-difluoromethoxy-1,1,2,2-tetrafluoroethyldifluoromethyl ether.

5. Use as foaming agents of near azeotropic compositions

a according to ~~claims 1 and 2~~ essentially consisting of:

A

composition

* by wt.

IX)	1-difluoromethoxy-1,1,2,2-tetrafluoroethyl	30-99
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difluoromethyl ether
 $(HCF_2OCF_2CF_2OCF_2H)$;
 dimethyl ketone (acetone)

- X) 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl
 difluoromethyl ether
 $(HCF_2OCF_2CF_2OCF_2H)$;
 n-hexane

70-1

15-99

85-1

wherein 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl difluoromethyl ether contains up to 40% by weight of difluoromethoxy-bis(difluoromethyl ether).

6. Use as foaming agents of near azeotropic compositions
Claim 1
 according to ~~claims 1 and 2~~ essentially consisting of:

1

composition

% by wt.

- I) difluoromethoxy-bis(difluoromethyl ether)
 $(HCF_2OCF_2OCF_2H)$;
 n-pentane

1-95

99-5

- VII) difluoromethoxy-bis(difluoromethyl ether)
 $(HCF_2OCF_2OCF_2H)$;
 n-hexane

30-99

70-1

wherein difluoromethoxy-bis(difluoromethyl ether) contains up to 50% of 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl difluoromethyl ether.

7. Use as foaming agents of near azeotropic compositions
Claim 1
 according to ~~claims 1 and 2~~ essentially consisting of:

1

composition

% by wt.

VIII) 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl difluoromethyl ether ($\text{HCF}_2\text{OCF}_2\text{CF}_2\text{OCF}_2\text{H}$); n-pentane

X) 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl difluoromethyl ether ($\text{HCF}_2\text{OCF}_2\text{CF}_2\text{OCF}_2\text{H}$); n-hexane

1-93

99-7

15-99

85-1

wherein 1-difluoromethoxy-1,1,2,2-tetrafluoroethyl difluoromethyl ether contains up to 50% by weight of difluoromethoxy-bis(difluoromethyl ether).

8. Use as foaming agents of ternary near azeotropic

a compositions according to ~~claims 1 and 2~~ essentially consisting of:

claim 1
A

composition
% by wt.

XII) difluoromethoxy-bis (difluoromethyl ether) ($\text{HCF}_2\text{OCF}_2\text{OCF}_2\text{H}$); 1,1,1,3,3-pentafluorobutane ($\text{CF}_3\text{CH}_2\text{CF}_2\text{CH}_3$, HFC 365 mfc) hydrocarbon 1-64 98-1 1-35

XIII) difluoromethoxy-bis (difluoromethyl ether) ($\text{HCF}_2\text{OCF}_2\text{OCF}_2\text{H}$); 1,1,1,4,4,4-hexafluorobutane ($\text{CF}_3\text{CH}_2\text{CH}_2\text{CF}_3$, HFC 356 ffa) hydrocarbon 1-22 98-43 1-35

9. Use of the compositions according to claim 8 wherein hydrocarbon is selected between n-pentane and iso-pentane.

- b* 10. Use of compositions according to ~~claims 8 and 9~~ wherein

claim 8
A

hydrocarbon is present in the range 1-20% by weight.

11. Use of azeotropic or near azeotropic compositions according to ~~claims 1-10~~ ^{claim 1} wherein the ether portion HFPE1 and/or HFPE2 can contain at least up to 10% by weight of hydrofluoropolyethers having the same structure but with boiling point in the range 5°-80°C.
12. Use as foaming agents, for the preparation of polyurethanes, of the compositions according to ~~claims 1-7 and 11~~ ^{claim 1}, mentioned at points I, II, IV, V, VI, VII, VIII, X, A, B, D, E, F, G, H and L.
13. Use of the compositions according to claim 12 in amounts in the range 1-15% by weight on the total preparation, including the same foaming agent; preferably 1.5-10% by weight, more preferably 1.5-8% by weight on the total formulation for the foam preparation.
14. Use of the compositions according to claim 12 in combination with H₂O and/or CO₂.
15. Use of the compositions according to claim 14 wherein the water amount is in the range 0.5-7, preferably 1-6, and more preferably 1-4 parts by weight on one hundred parts of polyol.
16. Use of the compositions according to claim 14 wherein the CO₂ amount is in the range 0.6-10 parts, preferably

1-8 parts by weight on one hundred parts of polyol.

- a* 17. Use of the compositions according to ~~claims from 1 to 16~~ ^{claim 1} wherein stabilizers for radicalic decomposition reactions are added, the concentration of which is in the range 0.1-5% by weight with respect to the foaming agent.
- a* 18. Use as foaming agents for thermoplastic polymers of the compositions according to ~~claims 1-11~~ ^{claim 1}, mentioned at points I, II, III, VII, VIII, IX, X, XI, XII, XIII, A, B, C, G, H, I, L and M.
19. Use of the compositions according to claim 18 in combination with foaming agents of physical type selected from CO₂, HFC 134a, HFC 227ea, HFC152a (1,1 difluoroethane), HFC 236ea (1,1,1,2,3,3 hexafluoropropane) or mixtures thereof.
20. Use of the compositions according to claims 18 and 19 in amounts in the range 5-30% by weight on the thermoplastic polymer.
21. Use of the compositions according to claims from 1 to 11 and from 18 to 20 wherein stabilizers for radicalic decomposition reactions are added, the concentration of which is in the range 0.1-5% by weight with respect to the foaming agent.
- Sub B³* 22. Polyurethane compositions comprising the foaming

a

compositions according to ~~claims 12-17.~~

⁴⁴ claim 12

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23. Compositions of thermoplastic polymers according to

claim 18

~~claims 18-21.~~

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